

- ATOC 568 -  
**Ocean Physics**  
Fall term 2020

**!!!! Note that this is a preliminary version that is subject to change !!!!**

## I/ Course overview

### **General information on class**

- Lectures: Tuesday and Thursday 01:05-02:25 PM
- Classroom: virtually held on Zoom
- Number of credits: 3

### **Instructor**

- Name: Carolina Dufour
- Email address: [carolina.dufour@mcgill.ca](mailto:carolina.dufour@mcgill.ca)
- Office and office hours: held on Zoom, Friday 11:00-12:00 PM & by appointment

### **Learning Outcomes**

In this course, you will learn about some fundamentals of ocean physics on seawater properties, processes contributing to stability and mixing, ocean circulations, wave phenomena and tides. You will also learn about the main observational and modeling techniques that allow scientists to monitor and study the ocean.

My goals for students in this class are:

- To build or deepen your general knowledge about the physical ocean,
- To give you some insight into how research in physical oceanography is conducted,
- To help you build some technical skills in programming, data analysis and modeling in relation with physical oceanography, as well as your oral and written communication.

This course builds on ATOC 512 (Atmospheric and Oceanic Dynamics) with digging further into what is characteristic to the ocean. In order to provide a general knowledge of physical oceanography, this course thus covers a large spectrum of topics rather than going in depth into one or two of them.

### **Instructional Method**

#### *Lectures*

Lectures will rely on:

- Slides presenting data, figures and take-home points
- Expositions at the whiteboard (including equations and hand-drawn sketches)

Slides will be made available on myCourses prior to the class.

### *In class*

Class times will include lectures, questions and answers, and activities (individual, by group or all together). Classes will be held online through Zoom (see Section on Zoom below) at the regularly scheduled class time. The online sessions will be recorded and made available on myCourses. Interactions are strongly encouraged in class at all time through asking questions and participating to activities.

### *Outside class (“at home”)*

You will be given assignments to do individually or in group to engage with the course material and build some important skills (e.g. programming, scientific writing). These assignments will be graded.

## **II/ Course Materials**

### **Required and optional material**

The course material consists of the lectures (slides and expositions at whiteboard) and reading assignments. *This course material is meant to be self-sufficient.* So, no additional material is required. However, some complementary reading might be helpful to seek additional information or different explanations in textbooks or websites. For your information, some books I have been using to build the course are listed here (as well as on myCourses):

- “The planetary Ocean”, Michelle Fieux  
→ Available at McGill Schulich library:  
<https://mcgill.on.worldcat.org/oclc/1003263679>
- “Atmosphere, Ocean and climate dynamics”, Marshall and Plumb  
→ Available at McGill Schulich library:  
<https://mcgill.on.worldcat.org/oclc/166317541>
- “Introduction to Physical Oceanography”, by Robert H. Stewart  
→ Free download at:  
<https://archive.org/details/IntroductionToPhysicalOceanography>
- “Descriptive Physical Oceanography: an introduction” by Lynne Talley  
→ Available at McGill Schulich library:  
<https://mcgill.on.worldcat.org/oclc/720651296>

### **Equipment and tools**

To follow classes remotely, you will need:

- A computer with internet connection
- The video conferencing app [Zoom](#) installed on your machine which is [provided for free by](#) McGill
- The word processor [Google Docs](#) which is accessed for free with a Google account (no need for a gmail address)

Optional: you can install on your machine [Jupyter Notebook](#) that will be used for some assignments and in-class activities. The installation requires [Python](#) (Python 3.3 or greater, or Python 2.7) to be installed.

## Course Content

The course is organized into five main parts which provide some essential knowledge and culture in physical oceanography: (I) Seawater properties and ocean basins, (II) Studying the ocean, (III) Mixing and stability and (IV) Ocean circulations, and (V) Wave phenomena and tides. Around week 5, there will be 4 classes dedicated to a modelling project. Classes will end with oral presentations from students.

The class schedule is as follows but is subject to change depending on how fast we will be able to cover the material. Assignment due dates might also change accordingly (watch for announcements in MyCourses):

Week	Date	Lecture	Assignment G: given O: due	
Week 1				
	2020-09-03	<b>Introduction</b>	paper synthesis & oral	
Week 2	2020-09-08	<b>I. Seawater properties and ocean basins</b> seawater properties, density, equation of state, sea ice, ocean basins and properties		
	2020-09-10			
Week 3	2020-09-15			
	2020-09-17		paper/chapter report	
Week 4	2020-09-22		<b>II. Studying the ocean</b> Observations, modelling and models	data analysis
	2020-09-24	paper synthesis (I)		
Week 5	2020-09-29			
	2020-10-01		paper/chapter report	
Week 6	2020-10-06	<b>III. Mixing and stability</b> air-sea exchange, mixed layers, mixing and diffusion, stability and convection, water masses + <b>Modelling lab</b> every Thursday		
	2020-10-08		paper synthesis (II)	
Week 7	2020-10-13			
	2020-10-15		homework	
Week 8	2020-10-20			
	2020-10-22		homework	
Week 9	2020-10-27			
	2020-10-29	<b>IV. Ocean circulations</b>	midterm exam	

Week 10	2020-11-03	fundamental equations, wind-driven circulation, thermohaline circulation, eddies	
	2020-11-05		data analysis
Week 11	2020-11-10		paper/chapter report
	2020-11-12		
Week 12	2020-11-17	V. Wave phenomena and tides	
	2020-11-19		paper/chapter report
Week 13	2020-11-24		In-class oral presentations
	2020-11-26		
Week 14	2020-12-01		
Exam period	TBA		modelling paper

Assignments will be handed accordingly to the dates indicated in the table above and posted on myCourses. Note that dates might be subject to change depending on how fast we will be able to cover the material. The table above indicates the dates when assignments are given (green), and the dates when assignments are due (orange). For most assignments, you will have several weeks to prepare. Be sure to plan accordingly as you will have to handle several assignments at the same time.

### **III/ Specifics about remote teaching**

#### **Zoom**

Live interactions between students and instructors will be done via Zoom. You are encouraged to install and test Zoom features prior to the beginning of the semester to foresee the technical issues. Some of the main features that will be used during live classes are: share screen, mute/unmute, start/stop video, ask/answer questions on the chat, and participate to polls. During class, you are welcome to ask questions anytime through the “raise hand” feature. Comments and questions are also welcome on the chat but might be answered after class as the chat will not be monitored at all time. All Zoom sessions will be recorded so that students who would miss a class can access to the course content (See more about recording in Section IV).

#### **MyCourses**

myCourses will also be used as a primary support for the course by hosting course material (lecture slides and recorded Zoom classes) and assignments. You should upload your assignments on myCourses in the dedicated assignment section, unless otherwise directed. A discussion board will be created on myCourses for students to interact on course material, ask questions, get help for assignments from their peers, etc. Discussion boards will not be monitored by the instructor. It is a

space dedicated to students.

## Communication

Communication will be handled primarily through myCourses. Please stay current with the site as there will be announcements made on assignments, exams, etc. You are welcome to come to office hours (see information on page 1) to ask questions about the course material, the assignments and exams. If you cannot attend office hours, you can contact me via email to schedule an appointment which will be held on Zoom.

## Resources and technical support

If you are experiencing some technical issues, you can contact one of the following options depending on the issue:

- Issues with university wide services (e.g. myCourses, personal device used to follow class):
  - Central IT: email ([itsupport@mcgill.ca](mailto:itsupport@mcgill.ca)); phone: (514) 398-3398; website: [IT Service Desk](#)
- Issues with Faculty of Science and departmental services (e.g. connecting to computer rooms):
  - Science IT: email ([science.it@mcgill.ca](mailto:science.it@mcgill.ca)); phone: (514) 398-7087

Teaching and Learning Services (TLS) also offer many [resources](#) to help students with remote learning environment.

## IV/ Course policies

### General statement

Attendance of all classes is required unless some difficulties arise (e.g poor internet connection, different time zones, health issues), in which case students should watch the recording of the Zoom sessions. Beyond the usual course material, these recordings will include some activities that are an integral part of the course and important pieces of information on assignments and exams.

Online class sessions held on Zoom will be recorded and posted on myCourses. You need to raise any concern you might have related to the recording of the class **at the beginning of the semester**. **Any use of class recordings outside of myCourses (e.g. posting the recording on internet) without the consent from all participants is prohibited.**

### Evaluation

The breakdown of the final grade is as follows:

Assignment name/type		Description	% of final grade
Projects	Data analysis	Outside class	15
	Modelling paper	In & outside class	20
Oral/written communication	Paper synthesis	Outside class	15
	Oral presentation	In class	20
Knowledge	Homework	Outside class	5
	Chapter report	Outside class	5
	Plot/comment figures	In & outside class	5
	Midterm exam	Outside class	15

More details about the assignments will be given in class as well as on myCourses. The objective of the homework is to help you prepare for the midterm exam. Note that there is no final exam. The final grade is composed of several assignments/exams with each not being worth more than 20% of the final grade. They are distributed so as to keep students engaged with class throughout the semester.

Digital copies of the assignments/exams should be uploaded on myCourses the day they are due. They will be accepted in the subsequent class at a penalty of 30%.

You are encouraged to work with classmates provided the assignments you hand reflect your own work at the end.

## Feedbacks

Feedbacks on the class are strongly encouraged. There will be at least one evaluation (mid-course) in addition to the final one (end-of-course evaluation) for me to get your feedback on the class.

## McGill Policy Statements

### - Language of Submission:

**(English)** *“In accord with McGill University’s Charter of Students’ Rights, students in this course have the right to submit in English or in French any written work that is to be graded. This does not apply to courses in which acquiring proficiency in a language is one of the objectives.”*

**(Français)** *« Conformément à la Charte des droits de l’étudiant de l’Université McGill, chaque étudiant a le droit de soumettre en français ou en anglais tout travail écrit devant être noté (sauf dans le cas des cours dont l’un des objets est la maîtrise d’une langue). »*

### - Academic Integrity:

**(English)** *“McGill University values academic integrity. Therefore, all students must understand the meaning and consequences of cheating, plagiarism and other academic offences under the Code of Student Conduct and Disciplinary Procedures” (see [www.mcgill.ca/students/srr/honest/](http://www.mcgill.ca/students/srr/honest/) for more information).*

**(Français)** « L'université McGill attache une haute importance à l'honnêteté académique. Il incombe par conséquent à tous les étudiants de comprendre ce que l'on entend par tricherie, plagiat et autres infractions académiques, ainsi que les conséquences que peuvent avoir de telles actions, selon le Code de conduite de l'étudiant et des procédures disciplinaires (pour de plus amples renseignements, veuillez consulter le site [www.mcgill.ca/students/srr/honest/](http://www.mcgill.ca/students/srr/honest/)). »

#### - Additional Statements

- “The [University Student Assessment Policy](#) exists to ensure fair and equitable academic assessment for all students and to protect students from excessive workloads. All students and instructors are encouraged to review this Policy, which addresses multiple aspects and methods of student assessment, e.g. the timing of evaluation due dates and weighting of final examinations.”
- “© Instructor-generated course materials (e.g., handouts, notes, summaries, exam questions, etc.) are protected by law and may not be copied or distributed in any form or in any medium without explicit permission of the instructor. Note that infringements of copyright can be subject to follow up by the University under the Code of Student Conduct and Disciplinary Procedures.”
- “[End-of-course evaluations](#) are one of the ways that McGill works towards maintaining and improving the quality of courses and the student’s learning experience. You will be notified by e-mail when the evaluations are available. Please note that a minimum number of responses must be received for results to be available to students.”